In search of Europe's information technology leaders: review of methods and empirical evidence

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Abstract. *Information technology (IT) leaders — companies that successfully exploit IT to achieve business results — generate immense interest among practitioners and academics. From a practitioner's perspective, IT leaders provide benchmarks of leading IT management practices which others may emulate to achieve success. From an academic perspective, IT leaders provide the 'data' for the creation of frameworks and theories of IT management. While US IT leaders are regularly assessed by academics, trade magazines, consultants and benchmarking firms, there has been no Europe-wide assessment of IT leadership. This neglect is detrimental to European IT practitioners and academics who may discover that American IT management practices are not transferrable in the European context. In this article, we analyse the construct, context and statistical validity of six methods for identifying European IT leaders. Based on this analysis, two methods (expert ratings and citation counts) were used to generate a preliminary list of European IT leaders and laggards. While individual experts were reticent about volunteering their ratings, their collective view appears to generate a worthwhile list with high construct validity. Citation counts represent a more accessible process for list generation, with high statistical validity. However, an attempt to correlate expert ratings with a list based on citation counts confirms that the latter has questionable construct validity.*

Keywords: Europe, information technology leaders, IT management, IT success

INTRODUCTION

In the US, information technology (IT) leaders are regularly profiled by academics, trade magazines, consultants and benchmarking firms. Academics have documented the success stories of American Airlines, American Hospital Supply, Merrill Lynch and McKesson (Clemons & Row, 1988; Copeland & McKenney, 1988; Venkatraman & Short, 1990). Trade magazines,

such as *Computerworld* and *CIO* magazine regularly publish lists of leading IT companies (Kelleher, 1993). Consulting firms, such as IBM, profile companies with 'Leading IT Management Practices' (Prairie, 1993). Benchmarking companies such as Compass America and Real Decisions regularly announce their 'best-of-breed' customers, including Ralston Purina and Ford (Molloy, 1990).

IT leaders generate immense interest among practitioners and academics. From a practitioner's perspective, they provide benchmarks of leading IT management practices which other companies may mimic to achieve success (Coleman, 1993; Green, 1994; Stratford, 1993). Bob Camp, the benchmarking champion at Xerox, argues that all companies can learn something by emulating best practices adopted by leaders:

> 'If all companies in the US pursued best practices function by function, we might have some major gains' (Linsenmeyer, 1991, p. 35).

From an academic viewpoint, IT leaders provide the 'data' for creating IT frameworks for best IT management practice. For example, through the study of IT leaders, several academics developed frameworks for exploiting the strategic potential of IT (Ives & Learmonth, 1984; McFarlan, 1984; Porter & Millar, 1985; Feeny & Ives, 1989). Entire academic schools, most notably Harvard, focus their prolific research program on case studies of leading companies and practices.

In contrast to the US, there has been significantly less attention paid to European IT leaders (Ciborra & Jelassi, 1994). Although several European academics have profiled individual firms, no Europe-wide assessment of IT leadership has been conducted. European IT practioners and academics question whether lessons generated from American IT leaders can be generalized to the European content. For example, two European academics express the frustration of teaching American-based cases to European students and practitioners:

> 'The European context is much less consistent and homogeneous for designing and implementing large-scale strategic information systems (SIS) even within the boundaries of the same multi-national corporation. Thus SIS investments that are justified in the USA, given the straightforward access to a large market, often become problematic in a fragmented terrain like Europe' (Ciborra & Jelassi, 1994, p.xviii).

Given that the European context may be significantly different than that in the US the need to identify and study European IT leaders is clearly evident. Studies of European IT leaders would provide an overdue awareness of the success of European organizations in exploiting IT, provide authoritative statements of what leading European companies are achieving with IT, and provide exemplars of best IT managerial practices associated with success in the European context. Given these benefits, finding these leaders proves a worthwhile pursuit.

This paper reports our search for, and presents some preliminary lists of, Europe's IT leaders. After exploring several methods, the lists were generated by two methods: (a) survey of IT experts from academe and practice to judge 240 European companies and (b) a citation count of IT-related press coverage from 1991 to 1994. Also reported are a preliminary list of European IT companies with apparently little claim to IT leadership. While the benefits of identifying IT

leaders are well recognized, we also recognize the need to identify a control group. We can only declare with confidence the best IT practices if those practices have been adopted in leading companies and not adopted in lagging companies.

While this paper reports preliminary results, it contributes to our understanding of fruitful and unfruitful methods of finding European IT leaders. Researchers may use these methods to identify other European IT leaders or to conduct case studies based on our preliminary lists to confirm or contest nominations.

METHODOLOGICAL REVIEW AND CRITIQUE

The search for Europe's IT leaders began with an examination of the literature for currently recognized IT leaders. Because so few identified European exemplars were found, the literature was searched for methods (used primarily in the US) to identify IT leaders. The idea was to replicate the most valid method in the European Community. These methods were categorized as external quantitative measures, individual case studies, benchmarking, peer review, expert review and citation counts. We analysed the validity of these methods using the following criteria (Kerlinger, 1966; Cook & Campbell, 1976; Nunnally, 1978).

1 Construct validity: the extent to which the method captures the theoretical construct of IT leadership and is not confounded with other constructs. In other words, does the method actually identify IT leaders as we have defined the construct, or does the method identify another construct, such as companies that spend large sums on IT?
2 Content validity: the extent to which the method captures an adequate sample of IT leaders to minimize the risk of oversight. In other words, are enough companies evaluated?
3 Statistical validity: the extent to which the method captures a large enough sample to make statistical conclusions. In other words: for a given company under review, are there enough people or measures to statistically judge the company's claim to IT leadership?

We proceed with an analysis of external quantitative measures.

External Quantitative Measures

Several authors have attempted to identify IT leaders using external quantitative measures, such as IT spend, terminal and PC penetration, productivity and profitability. The main strengths of these methods are high content and statistical validity, but they also have poor construct validity. Rather than finding IT leaders in terms of IT-enabled business achievement, they tend to find companies that spend a lot of money on IT with questionable value (Quinn & Bailey, 1994).

Researchers in the US in particular have conducted a plethora of studies to try to identify IT leaders by looking at the external quantitative variables of IT spending and productivity. They attempted to find a statistical relationship that showed that the more money spent on IT, the more productive/profitable a company will be. Instead, attempts to correlate investments in IT to

increases in productivity have generally found no correlation or a negative correlation. These findings have been labelled the 'information technology/productivity' paradox. Some specific research examples:

- A study of 60 manufacturing firms during the period of 1974–1984 failed to show a significant positive relationship between IT expense and productivity (Kauffmann & Weill, 1989).
- A study of 58 mutual savings banks found no relationship between organizational performance and IT expense (Kauffmann & Weill, 1989).
- An evaluation by the US Department of Commerce for the years 1950–1986 shows a negative correlation between information technology and productivity (Roach, 1988).
- A research report by the Gartner Group revealed that firms that invested in office automation systems had exactly the same level of productivity in 1987 as they did in 1967 (Sivula, 1990).
- Japan and Europe have much higher office and service sector productivity than the US even though they have not computerized nearly as quickly as the US (Thurow, 1989a,b).
- Peter Drucker observes that the number of office workers and clerical staff grow in proportion to investments in information technology (Drucker, 1991).
- When productivity figures are decomposed by industry, the following trend emerges; the service industries that invest the most in IT exhibit the worst productivity figures (Anon 1991; Roach, 1989). For example, Finance, Insurance & Real Estate invest the most in information technology yet have experienced no growth or negative growth in productivity.

In the UK, a similar result was found. Hochstrasser & Griffiths (1987) interviewed and distributed a questionnaire in 12 British companies to determine factors which distinguish an IT leader (advanced user of IT) from IT laggers (unsophisticated users of IT). They found no correlation between IT spend and 5 year profitability or 5 year peer profitability comparisons.

Generally, three interpretations are offered to explain the paradox. First, some researchers argue that IT does not increase productivity/profitability (i.e. the paradox is correct). Lester Thurow, one of the greatest critics of IT, contends that IT does not increase productivity because (a) IT departments merely automate inefficient manual processes and (b) because IT creates more data rather than solves problems. For example, Thurow notes that the computerization of accounting systems has caused the number of accountants to outgrow management's ability to steward them. Global figures show that when GNP increased by 30% the number of accountants increased by over 40%, indicating a general loss in productivity (Thurow, 1989a,b).

Secondly, researchers argue that IT will increase productivity, we just haven't waited long enough. For example, Meltzer (1993) argues that we will not feel the productivity effects of IT for some time because we are still adapting to the technology. He offers a historical analogy to the invention of electric motors in 1860. He argues that we did not fully experience the effects of that technology for 50 years, thus we should afford IT the same time to prove itself.

Thirdly researchers argue that IT does increase productivity, but inherent flaws of external quantitative measures create the paradox. The paradox is difficult to accept because it is counter-intuitive. Every day we see evidence that information technology increases productivity-automated tellers, laser checkout systems, fax machines, word processors and travel

reservation systems. Because the paradox runs counter to intuition, the problem must lie with the measurement's poor construct validity and not with the technology. Researchers argue that external quantitative summations cancel out the effects of variables thought to have a significant impact on productivity — the interaction between humans and information technology (Strassmann, 1985). Thus, some IT investments may be great successes or great failures, depending on how IT is implemented. The contingency factors are completely discarded in external quantitative studies. Researchers argue that these studies have no internal validity because the paradox merely captures a correlation, not a causal relationship. Perhaps productivity and profitability would have suffered a worse deterioration without investments in IT. Researchers argue that external quantitative studies consider worker productivity or company profitability rather than net benefits to society. For example, automated tellers may not correlate with higher banking productivity, but society as a whole benefits from convenient, 24 hour banking. Strassmann (1985), for example, notes that benefits of office automation come from improved quality of customer care, not office worker productivity, but such measures have not been operationalized.

Most recently, Strassmann (1994) has compiled a new Premier 100 list of IT leaders for *Computerworld* using external quantitative measures that do not rely on IT spend. He argues that IT productivity can be measured from annual reports using the following equation:

$$\text{IT Productivity} = \frac{\text{(operating profits after taxes-value of shareholder equity)* cost of capital}}{\text{cost of sales, general expenses and administration}}$$

He argues that this equation 'measures and rewards the effectiveness of corporate management', which he assumes is significantly enabled through IT (Strassmann, 1994, p.45). This is a huge leap in logic — the value of management presumably relies on their knowledge, experience, creativity and leadership, much of which will not be captured or communicated through IT (Minzberg, 1973). Although Strassmann's metric avoids the trap of IT spend measures, his resulting equation cannot clearly claim to capture the value of IT.

In general, we conclude from the plethora of US evidence that external quantitative measures have poor construct validity and that a replication in the European context seems fruitless.

Individual Case Studies

Case studies of individual companies can be used to identify IT leaders. This method has high construct validity because the researchers gain insider knowledge of a company to enable sound assessments of leadership. However, the method has poor content and statistical validity because only an opportunistic sample of a few companies are studied. Although less individual cases have been written on European IT leaders compared to the US, some academics are beginning to profile European IT leaders:

- Cottrell and Rapley (1991) analysed the success of executive information systems in British Airways.
- Mutch (1993) studied the successful implementation of IT in the UK's Country Holidays.

- Bjorn-Andersen and Turner (1994) have studied how IT enabled radical transformation at Oticon, a Danish manufacture of hearing aids.
- Ciborra (1994) has analysed the global technology strategy of Olivetti, one of Europe's leading IT companies.
- Janson and Taillieu (1994) have studied the impact of IT on Colruyt's success in competing in the Belgian food industry.

Of particular note is a collection of case studies found in *Strategic Information Systems: A European Perspective* (edited by Ciborra & Jelassi, 1994). Various authors profile France's Minitel system, Shorko Films in France, the UK's BP Chemicals, Finland's Skandia International and Union Bank of Finland. Each author carefully documented changes in the industry environment which invariably required companies to reposition their market strategies. The authors present a rich description of how IT was used to support the competitive repositioning.

While the few smatterings of case studies provide a sound contribution to our understanding, they do not represent a Europe-wide, rigorously researched identification of IT leadership. While the cases provide exposure to European IT leadership, the authors do not provide a rationale for selecting these companies over others, leading to poor content and statistical validity. Are these companies indeed the best that Europe has to offer?

Benchmarking

Benchmarking is the practice of measuring internal IT performance against other companies' IT performance. Benchmarks are typically conducted by consulting firms or benchmarking companies that measure performance and practices for client companies. After enough companies are assessed, the 'best-of-breed' companies surface as IT leaders. Some examples include:

- Andersen Consulting's benchmark of IT Value
- American Express/IBM Benchmark of Best IT Management (Prairie, 1993)
- Compass and Real Decisions benchmarks of operational efficiency (Molloy, 1990)
- British Computer Society/Hay awards for Excellence in IT Management

The variety of benchmarks makes it difficult to assess the general validity of the method. Some benchmarks possess high construct validity, such as Anderson's and IBM's benchmarks which were targeted at using IT to achieve business success. However, they possess poor content and statistical validity because only clients are assessed, thus many IT leaders may be overlooked; for example, the AE/IBM benchmark was based on only 17 companies. Other benchmarks, developed by such companies as Real Decisions, have high content and statistical validity due to the large client database of over 250 companies (Freedman, 1992). However, in terms of IT leadership, this benchmark's construct validity is questionable; does operational efficiency of data centres relate to exploiting IT leadership for business success?

More practically, academics cannot generally access benchmarking results because consulting firms and benchmarking services do not name their list of best-of-breed candidates. Instead, they merely profile the best practices of an anonymous best-of-breed. However, there

are exceptions; Compass announces their most efficient data centre clients, most recently Talston Purina. Recent winners of The British Computer Society and Hay Management Consultants award for Excellence in IT Management include Tesco Stores, Cheshire County Council and City University Business School. In general, however, researchers cannot access a Europe-wide list of IT leaders produced through benchmarking.

Peer Ratings

Some US lists of IT leaders are based on peer ratings, such as prior versions of *Computerworld*'s Premier IT 100 (Kelleher, 1993). Peer review entails calling CIOs (or equivalent title) and asking them: 'Excluding yourselves, who in your industry are IT leaders?' The construct validity of this approach is high; when competitors recognize that another company's IT excellence changes the nature of competition, one can identify IT leaders with confidence. However, while this method works well in the US culture where IT managers routinely network in IT clubs sponsored by universities, industry groups and consulting firms, our pilot of this method proved less successful. When asked about the achievement of their peers, European IT Directors hesitated and offered no clear leadership candidates. In general, we found the European culture to be less open and that IT managers network much less. As a result, the content, construct and statistical validity of replicating this approach in the European context is extremely low.

Expert Ratings

Some US lists of IT leaders are based on expert ratings, such as *CIO* magazine's list of the top 100 companies using IT to increase customer satisfaction (*CIO*, 1992). The list was created by a panel of experts of academics and consultants. The method used by *CIO* had several rounds of ratings. In the first round, experts were asked to nominate companies. The list generated was then circulated to all the experts for rating. Experts could decline to rate a given company if they possessed no opinion.

This method has high construct validity because experts possess insider knowledge which enables them to assess claims to IT leadership with confidence. If enough companies are assessed, the method can have high content validity. If enough experts are polled, the method can also have high statistical validity. Because of the strong construct validity of this approach, we felt that this method could be replicated in Europe, reasoning that academics and practitioners with insider knowledge could assess a given company's IT capabilities. We were unsure, however, whether we could find enough experts to assess enough companies to achieve high content and statistical validity.

Citation Counts

Although expert review offers a high construct validity, we also wished to employ a supplemental method that guaranteed high content and statistical validity. Because we dismissed

external quantitative measures as an option due to poor construct validity, we though that citation counts might offer a valid alternative. Citation counts consist of counting the number of articles or references on a given unit of analysis from existing sources such as annual reports, newspapers, journals and trade magazines. Although we did not find that this method had been used to identify IT leaders, it has been used in other IT contexts. For example, Culnan (1986) and Culnan & Swanson (1986) used citation counts to identify the most influential IT articles and researchers. Jarvenpaa & Ives (1990) used the number of IT phrases in over 600 letters to shareholders as indicants of the importance of IT to corporate strategy. Although the construct validity for IT leadership was yet unproven, we felt that citation counts offered high enough content and statistical validity to warrant investigation.

Conclusion

Table 1 summarizes the validity of the methods for identifying IT leaders. Based on our analysis, we used two approaches: expert review and citation counts. While we were confident that expert reviews offered high construct validity, we hoped to complement this measure with the more rigorous approach offered by citation counts.

Table 1. Summary of methods to identify IT leaders

Method	Strengths	Weaknesses
External quantitative measure	Strong content validity Strong statistical validity	Poor construct validity
Individual case studies	High construct validity	Poor content validity Poor statistical validity
Benchmarking	Varies by benchmarking service	Varies by benchmarking service
Peer review	High construct validity in USA: High content validity High statistical validity	In Europe: Poor statistical/content validity: Low response rate due to European culture
Expert review	High construct validity High content validity if enough companies assessed High statistical validity if enough experts polled	Low content validity if not enough companies assessed. Low statistical validity if not enough experts polled.
Citation counts	Strong content validity Strong statistical validity	Unproven construct validity

RESEARCH METHODOLOGY

Expert Review

We first sought to identify European IT leaders by administering a pilot survey to IT experts in the UK using the method employed by *CIO* magazine. We sent the survey to five UK experts: an academic conducting research in strategic information systems, a partner in an IT consultancy company, an editor of a UK computer magazine, president of a UK IT conference event organizer and chairman of a UK consortium of IT practitioners.

The experts were asked to identify IT 'leaders', 'losers' and 'laggards' for UK companies operating in the following industries: Consumer Products, Financial Services, Government, Process Industries (Oil, Gas, Chemical, Pharmaceuticals, Metals), Retail Stores, Manufacturing (Automotive, Aerospace, Shipbuilding, Capital Equipment), Transportation Services (Air, Sea, Land), Utilities and Other. In our cover letter, we defined IT 'Leaders', 'Loser' and 'Laggards' as follows:

> IT leader: An organization that successfully uses information to improve the organization's competitive positioning.
> IT loser: An organization that spends a significant amount of money on IT but fails to improve the organization's competitive positioning
> IT laggard: An organization that views information technology as a utility and therefore does not attempt to use information technology to improve the organization's competitive position.

Only two of the five experts responded, and from these, only a few leaders and laggards were identified and no losers. There was no over-lap between the two respondents, each identified a different set of IT leaders. Upon calling the respondents, they said they were extremely reticent about identifying information technology 'losers' and 'laggards'. They also found it difficult to 'paint the blank canvas', as our questionnaire did not ask experts to respond to a list of companies, but instead invited them to nominate any company they wished. We learned two lessons from this pilot questionnaire. Firstly, we needed to re-word the categories so as not to request respondents to identify 'losers' and 'laggards'. Secondly, we needed to provide a preliminary list of companies to prompt the experts.

The expert questionnaire was re-designed as follows. To prompt experts, we selected the subset of 240 European companies listed among *Business Week*'s Global 1,000 companies. We reasoned that this list would likely contain a plethora of IT leaders and as well as laggards because of the sheer size of these companies, ensuring high content validity. The list also contains companies operating in various industries in both manufacturing and service sectors. Based on this list, 10 versions of the questionnaire were created to administer to experts in 10 European countries. Each expert was asked to indicate the extent to which they think a given company can claim to be an IT leader. Experts had three choices to respond; 'strong claim', 'some claim', and 'little claim'. We also invited experts to specify a specific business unit within a company if their judgement was based only on a business unit rather than the entire company. To facilitate their response, we defined leadership as follows:

IT leader: an organization that successfully uses IT to differentiate a company's products, services, and/or prices from its competitors by improving product quality, shortening product development or delivery time, creating new IT-based products and services, improving customer service before, during, or after the sale, or lowering product prices by lowering internal costs, including IT unit costs.

Experts were also invited to nominate up to five additional IT leaders which may not have appeared on the list. In this way, it was hoped to avoid excluding smaller companies that might be IT leaders (see Appendix A).

We identified academic experts working in these 10 countries from a SISNET membership list and from the Copenhagen Business School's *Directory of Information Systems Faculty in Europe.* SISNET is a consortium of European academics who conduct research in strategic information systems. The *Directory* provides each faculty member's area of expertise, so we selected members who researched strategic information systems or broad IT management issues. Between these two sources, 130 academics were identified. We also identified 10 practice leaders from two IT consultancy practices, yielding a sample size of 142 experts. Thirty-nine experts responded, yielding a response rate of 27.46% (see Table 2).

Citation Counts

We conducted an on-line search of Data-Star TEXTLINE FOCUS, which is an international business news database. Coverage is world-wide, but with a European emphasis, and contains 500 sources of information from news wires, newspapers and magazines. The database is updated daily, but archives date from 1980 onward.

Table 2. Expert responses

Country	No. of companies expert asked to judge	No. of questionnaires sent	No. questionnaires received
Belgium	9	7	1
Denmark	4	16	3
France	44	12	3
Germany	32	36	13*
Italy	11	8	3
Netherlands	14	21	6
Spain	10	10	5
Sweden	10	8	1
Switzerland	13	3	1
Great Britain	93	21	6
Total	240	142	39

*3 were virtually blank and not used in analysis

The on-line search was conducted as follows. For the 245[1] companies listed on the questionnaire, we counted the total articles written about each company since 1991, and the number of these which contained the key words 'information technology' or 'information system' (IT or IS). We then calculated the percentage of IT or IS articles to control for the number of articles by dividing the number of IT or IS articles by the total number of articles for each company. In total, there were 716 544 articles written on the 245 companies since 1991 (see Table 3). Of these 8685 of them were IT or IS related. Our question was, however, is it good news or bad news if the press reports a large number of IT or IS related articles for a particular company? Because we wanted to use the number of citations as a surrogate indicator of IT leadership, we needed to confirm that most IT press was good press.

To determine the content of the press coverage as either positive or negative, a content analysis of the IT or IS articles was conducted on the companies from two countries: Belgium and Italy. Because of the expense (articles must be down-loaded while on-line to Reuters) and number of IT or IS related articles, it was hoped that a sample of two countries would provide enough indication of the typical content of IT press coverage. In total, 153 articles were reviewed, representing 1.8% of the 8685 IT or IS articles written. The analysis shows that 99.35% of the IT or IS articles reported positive accounts of recent IT-related partnerships, activities of IT-related businesses within companies, or leading IT systems. Only one article of the 153 reported an IT failure.

Belgium

Forty-three articles were written about the nine Belgian companies from January 1991 to September 1994. All articles were positive and fell generally into two camps: announcements of benefits expected from newly-formed IT-related partnerships with other companies and descriptions of existing successful IT systems that cut costs or improved managerial control. See Table 4 for a sample of articles.

Table 3. Descriptive statistics of expert responses and citation counts

Variable	Mean	STD Dev	Minimum	Maximum	Count
Total # articles	3,075	3,059	18	15,908	716,544
Total IT or IS articles	32	86	0	812	8,685
Per cent	0.009	0.012	0.000	0.099	NA
Normal expert weighted average	0.450	0.670	–1.00	2.00	NA
'Strong' responses	0.846	1.34	0	8	207
'Some' responses	1.078	1.22	0	6	264
'Little' responses	0.771	1.01	0	5	189
'No Opinion' responses	2.355	2.11	0	9	577

[1] In addition to the 240 companies on the Global 1000 list, we included five companies identified by experts on the open-ended question.

Table 4. Content analysis of Belgian IT or IS related articles

Company	No. of IT or IS articles	Content
AG Group	3	Several subsidiaries are IT companies which earn a profit supplying midrange systems
Electrabel	1	Partnership with DEC to build plant systems worth $3.5 million
Group Brussels Lambert	1	Partnership with Air France to share IT costs.
Petrofina	6	IT implemented in retail stores to improve management control.
Societe Generale de Belgique	12	Subsidiaries basing growth strategy on IT investments; Partnership for shared IT port management systems; Partnership with shipping lines for EDI
Solvay	3	Partnership with Gandalf to build network worth $1 million
Tractebel	0	NA
Generale de Banque	9	IT used to cut costs; EDI cut costs by 50%.
Kriedietbank	9	Pilot EDI systems with banks; Partnership with EDS to build international banking system

Italy

In Italy 110 IT or IS related articles were written about 13 companies from the period January 1991 to September 1994. Results were the same as for Belgium, with press reporting either recent IT-related partnerships or leading IT systems. There was one exception: Banca di Roma's disastrous merger was largely blamed on the inability to integrate IT systems from the three merged banks (*Banking Technology*, 1993, p.30).

Based on this sample, we felt confident that the vast majority of press coverage was positive. Some may argue that announcements of 'strategic partnerships', particularly in the case of IT outsourcing, may actually be negative news. However, Loh & Venkatraman (1992) found that outsourcing announcements result in temporary rises in stock prices, signalling that investors perceive that IT outsourcing in a positive light. When such IT outsourcing relationships result in failure, company identities are usually reported anonymously in the trade press (Lacity & Hirschheim, 1993), which explains why our search based on company name produced almost no IT failure. From the content analysis, we were somewhat more confident that the number of citations could be used as a surrogate indicator of IT leadership.

RESULTS OF EXPERT SURVEY AND CITATION COUNTS

Expert Review

At a first glance of the expert responses, experts often expressed conflicting views on the same company: some experts claimed strong IT leadership while other experts suggested little claim to IT leadership. This may be due to the fact that each expert was thinking of a particular strategic business unit within a company. Although we asked experts to fill in an SBU for a given company, most experts left this column blank. To extract a preliminary list of European IT leaders from the survey, we calculated a normalized weighted average of the expert responses as follows:

$$\text{WGTAVG} = \frac{2*(\#\text{ Strong Claim}) + 1*(\#\text{ Some Claim}) - 1*(\#\text{ Little Claim}) + 0\,(\#\text{ No Opinion})}{(\#\text{ of experts responding})}$$

Leading IT companies were identified as any company with a weighted average score exceeding 1. As Table 5 indicates, 42 of the 245 companies scored over 1, with 5 of the 42 entries coming from nominations identified by experts which were not on our pre-selected list of *Business Week*'s Global 1000.

Due to the sample size, we were most confident of the German, Dutch and UK results, but were reticent to proclaim IT leadership in countries with less than six expert responses. Table 5 was sorted first by number of experts responding and then by weighted average to provide an indicant of confidence. Thus, we are most confident that the top entries in Table 5 are IT leaders, with confidence waning as the list progresses.

On the second part of the questionnaire, experts were invited to state their reasons for nominating candidates. The experts' comments provide some confirmation as to the construct validity of the approach, as they stressed the business aspects of IT implementations. In general, the participants either stressed that IT was successfully integrated to business functions, or they stressed that IT innovations were successfully implemented to achieve business objectives. Unlike other methods, experts did not merely nominate companies that spend significant amounts of money on IT (as is often the case with external measurement methods); nor did the experts nominate on the basis of operational efficiency (often the focus of benchmarking methods).

The following comments provide an indicant of the types of reasons experts provided:

- BMW: 'IT is heavily enfolded into business functions.' 'IT is necessary to achieve their leadership in German car productivity.'
- Siemens: 'Production of Apparatus/Products which needs integrated IT.'
- Deutsche Bank: 'Efficient link to business and IT strategy and also use of sophisticated IT strategy'.
- Mannesmann: 'Using external databases for strategic analysis.'
- HSBC/Midland: 'At First Direct, [we] developed new practical concept of branch banking service based on integrated use of IT to meet customer needs and achieve high levels of customer satisfaction.'

- Royal Bank of Scotland: 'Direct Line insurance . . . launched direct insurance services via IT centre and achieved very low costs, very competitive prices, and hence very quickly, large market share.'
- La Caixa: 'IT innovator in service selling through ATMs.'
- Lego: 'Highly market oriented producer of toys with efficient world-wide IT-based market support.'
- Oticon: 'The IT leadership does not come from technology, but from exploiting state of the art technology.' 'Uses IT to achieve a paperless office to help employees work in teams.'
- Fininvest: 'Real time MIS used for TV management.' 'New business units with high IT role consistent with competitive strategy, especially in sport, business and entertainment.'
- Benetton: 'Integrated information systems from sales to supplies (from POS to EDI).'
- Roche Holding: 'Heavy awareness of strategic information systems, especially in the pharmaceutical divisions.'
- Electrolux: 'Leading edge use of IT does not seem to depend on MIS Department, but rather on product developers and controllers.'

We also report the bottom 12 companies which were rated as 'Little claim' to IT leadership by experts (see Table 6). Only companies with normalized weighted average less than or equal to –0.50 were included. Although many other companies were rated negatively, we were extremely cautious about producing, let alone interpreting, a long list. It is noted that 'Little claim' does not necessarily translate to 'IT losers' or even 'IT laggards'. Given the questionnaire design, experts could conceivably rate average performers in this category. We include this list because it serves as an appropriate control group to compare 'non-IT leaders' with 'IT leaders'.

The means of the expert responses are particularly interesting when broken down into the number of 'Strong claim', 'Some claim', 'Little claim', and 'No opinion' responses (see Table 3). On average, experts were most likely to offer a 'No opinion' judgement. This is understandable given the number of companies some experts were asked to judge (93 companies in the UK for example). After 'No opinion', the most common response was 'Some claim'. This too is understandable; of the experts spoken to after the survey, many suspect a company to be an IT leader (perhaps based on press coverage) but are reticent to render a strong response. The third most likely response was 'Strong claim' to IT leadership. Perhaps most interesting, experts were least likely to declare a company as having 'Little claim' to IT leadership. This was also noted previously in the feedback from the Pilot survey. Within the European culture it is 'impolite' to label any company negatively.

Citation Analysis Results

On average, the trade press published 3075 articles per company during the period from January 1991 to September 1994. Barclays Bank, a UK bank, had the most press coverage with 15 908 articles and Dordtsche Petroleum, a Dutch energy company, had the least with 18. On average, the trade press published 32 IT or IS related articles per company during the same time period. Siemens, the German computer and electricals company, enjoyed the most IT

Table 5. 'Strong claim' to IT leadership sorted by confidence

Country	Company	Strategic business unit	Industry	No. of experts	Weighted average
Germany	BMW		Automotive	10	1.60
Germany	Siemens		Electricals, Computers	10	1.60
Germany	Daimler-Benz		Automotive	10	1.40
Germany	Deutsche Bank		Banking	10	1.30
Germany	Mannesmann		Engineering	10	1.30
Germany	Volkswagen		Automotive	10	1.30
Germany	Dresdner Bank		Banking	10	1.10
Netherlands	Ahold		Food	6	1.50
Netherlands	Royal Dutch Petroleum		Oil & Gas	6	1.30
UK	British Airways		Airline	6	1.67
UK	Reuters Holdings		Media	6	1.67
UK	HSBC Holdings	First Direct	Banking	6	1.33
UK	Royal Bank-Scotland	Direct Line Insurance	Banking	6	1.33
UK	Sun Alliance	Vulcan Insurance	Insurance	6	1.17
Spain	Banco di Santander		Banking	5	2.00
Spain	La Caixa*		Banking	5	2.00
Denmark	Dampskibsselskabet		Freight	3	1.33
Denmark	Lego*		Toys	3	1.33
Denmark	Oticon*		Medical Products	3	1.33
Italy	Gruppo Bancario		Banking	3	2.00
Italy	Fininvest*		Media	3	2.00
Italy	Fiat		Automotive	3	1.67
Italy	Benetton*		Retail Sales	3	1.33
France	BSN		Food	3	1.67
France	Elf Aquitaine		Oil & Gas	3	1.67
France	Bouygues		Construction	3	1.33
France	Canal Plus		Media	3	1.33
France	Cetelem		Banking	3	1.33
France	Financiere de Suez		Banking	3	1.33
France	L'Oreal		Cosmetics	3	1.33
France	Peugeot		Automotive	3	1.33
Belgium	Kredietbank		Banking	1	2.00
Switzerland	BBC Brown Boveri		Construction	1	2.00
Switzerland	CS Holding		Banking	1	2.00
Switzerland	Roche Holding		Health & Household	1	2.00
Switzerland	Schweiz. Ruck		Insurance	1	2.00
Switzerland	Swiss Bank		Banking	1	2.00
Sweden	ASEA		Engineering	1	2.00
Sweden	Electrolux		Electricals	1	2.00
Sweden	L.M. Ericsson		Communications	1	2.00
Sweden	Volvo		Automotive	1	2.00

* company nominated by experts on opened question

Table 6. Expert rankings: 'Little claim to IT leadership' sorted by confidence

Country	Company	Industry	No. of experts	Weighted average
UK	Standard Chartered	Banking	6	–0.50
UK	Guardian Trust	Insurance	6	–0.50
UK	Hanson Trust	Multi	6	–0.50
UK	Lloyds Abbey Life	Insurance	6	–0.50
UK	Wellcome	Health	6	–0.50
Spain	Banco Central	Banking	5	–1.00
Spain	Banco Popular	Banking	5	–0.80
Spain	Pryca	Merchandising	5	–0.60
France	Alcatel Cable	Capital Equipment	3	–0.67
Switzerland	SMH	Recreation	1	–1.00
Sweden	Procordia	Multi	1	–1.00
Sweden	Stora Kopparbergs	Forest	1	–1.00

press coverage with 812 articles published. Fifteen of the companies (6%) had no IT articles about them published.

The average percentage of IT or IS related articles (IT or IS related articles divided by the total articles published) is 0.009, less than 1 per cent. Reuters Holding has the highest percentage of IT related articles at 0.099, which is understandable given that their business is on-line access to business information.

Table 7 contains a list of the top 23 companies generated from the citation counts. The criteria for entrance to this list was that a given company had to have a percent of IT or IS articles over 0.02; or the number of IT or IS articles exceeded 100. While we were confident in the statistical and content validity of Table 7, we questioned the construct validity: Does this list represent IT leaders? We have highlighted the 7 out of 23 companies (30%) which also appeared (Table 5) on the list based on expert responses.

Table 8 contains a list of the 15 companies that had no IT or IS press coverage. We again are cautious to interpret this list, and do not suggest that these companies are 'IT losers'. Many explanations exist for the lack of exposure, all IT may be in-house, thus no announcement of partnerships would be made, the company may avoid press coverage in general or even complex legal relationships may mean that the Reuters code used to index the database by-passed company subsidiaries which did have press coverage.

CORRELATION ANALYSIS

To make a better assessment of the construct validity of the citation analysis, we wanted to correlate the expert responses to the citation counts (Campbell & Fiske, 1959). If the two methods were highly correlated, we could be confident a combined list of IT leaders, such as the seven companies appearing on both our lists, would possess construct, content, and statistical validity. The expert responses were correlated using normalized weighted averages of expert

Table 7. IT or IS related articles: companies most often cited

Country	Company	Industry	Total IS or IT	Per cent
UK	Reuters Holding*	Business	360	0.099037
UK	TI Group	Multi	113	0.080142
Germany	Siemens*	Electricals	812	0.072727
Netherlands	Philips Electronics	Appliance	530	0.058019
Denmark	Oticon*	Health	1	0.052632
Belgium	AG Group	Insurance	3	0.044118
UK	British Telecom	Telecommunications	612	0.043491
UK	Great Universal Stores	Merchandising	33	0.042254
Sweden	LM Ericsson*	Electricals	150	0.038730
UK	Cable & Wireless	Telecommunications	195	0.034157
UK	General Electric	Electricals	261	0.032250
France	Thomas-CSF	Aerospace	76	0.032095
UK	Thorn EMI	Appliance	125	0.026899
UK	Marks & Spencer	Merchandising	110	0.025858
Germany	Preussag	Multi	37	0.023933
Netherlands	Elsevier	Media	32	0.022873
UK	Reed International	Media	110	0.020465
UK	HSBC Holdings*	Banking	156	0.017122
UK	British Airways*	Airline	184	0.016102
UK	Barclays Bank	Banking	256	0.016093
UK	National Westminster	Banking	219	0.015445
UK	British Petroleum	Energy	135	0.010205
Germany	Daimler-Benz*	Automotive	130	0.010096

☐ Company also rated as IT leaders by experts

responses and citation counts. We also correlated a decomposition of expert responses (strong, some, little, no opinion) with citation counts using the total number of articles, total IT or IS related articles and the percentage. Table 9 presents the results of the citation analysis.

Although 11 of the 15 correlations between the expert responses and the citation counts are statistically significant, the correlation coefficients are small enough to question whether the association is relevant. Decomposition into the individual responses suggests a pattern that ties press coverage with expert opinion. Strong responses are positively correlated with press coverage. That is, the more IT or IS specific press coverage, or press coverage in general, the more likely the expert would judge a company to have a strong claim to IT leadership. Conversely, the absence of press coverage negatively correlates with a 'No opinion' response. That is, the less articles written, the more likely an expert will have no opinion. We interpret these results to suggest that either press coverage influences experts' opinions to a moderate extent or that citation counts possess at least some construct validity.

We also analysed whether there was a significant country effect. We wanted to know whether within a country, if we ranked companies on the basis of IT leadership, the experts would rank the companies in the same order as an ordering by citation counts? To answer this, we

Table 8. IT or IS related articles: companies with no IT or IS press coverage

Country	Company	Industry	IS or IT articles
Belgium	Tractebel	Multi	0
Denmark	Dampskibsselskabet	Shipping	0
France	Campagnie de Navigat	Multi	0
France	Eridania Beghin-Say	Food	0
France	Legrand	Electricals	0
Germany	Victoria	Insurance	0
Germany	Isar-Amperwerke	Utility	0
Germany	VEW	Utility	0
Italy	Alleanza Assicurazioni	Insurance	0
Netherlands	AMEV	Insurance	0
Netherlands	Dordtsche	Energy	0
Spain	Pryca	Merchandising	0
Switzerland	Holderbank	Build	0
UK	Smith & Nephew	Health	0
UK	Waste Management	Service	0

Table 9. Correlation between expert responses and citation counts

	Total articles published	IT or IS articles published	Per cent
Weighted average	r = .2027 p = +002	r = 0.1347 p = 0.040	r = 0.1277 p = 0.051
Strong	r = .3028 p = .000	r = 0.3008 p = 0.000	r = 0.2439 p = 0.000
Some	r = .2414 p = .000	r = 0.1369 p = 0.037	r = 0.0377 p = 0.567
Little	r = .0610 p = .000	r = 0.0310 p = 0.638	r = –0.0495 p = 0.452
No opinion	r = –.1380 p = +035	r = –0.0680 p = 0.301	r = –0.1422 p = 0.026

Significant at alpha = 0.10

calculated Spearman Rank Correlations for countries in which we had at least 5 experts responding. Table 10 indicates that we find the strongest relationship between expert responses and citation counts in Germany.

The correlations are significant and relevant: if we were to rank order the 32 German companies by either expert responses or citation counts, we would derive very similar lists. Again, we can interpret this result in two ways: either German press coverage influences expert opinion or citation counts possess high construct validity. Statistically significant results were also found in the Netherlands and the UK, but the correlation coefficients indicate that the lists would not be similar enough from a practical stand. No statistical relationship was found in Spain.

Table 10. Spearman rank correlations for countries with > 4 experts responding

Country Expert responses: Weighted averages	Total articles published	IT or IS articles published	Per cent
Germany n = 10 experts, 32 companies	r = 0.6642 p = 0.000	r = 0.7278 p = 0.000	r = 0.7023 p = 0.000
Netherlands n = 6 experts, 14 companies	r = 0.4583 p = 0.093	r = 0.4476 p = 0.109	r = 0.2918 p = 0.311
Spain n = 5 experts, 11 companies*	r = 0.3105 p = 0.353	r = 0.2746 p = 0.414	r = 0.2740 p = 0.415
UK n = 6 experts, 93 companies	r = 0.2347 p = 0.028	r = 0.3600 p = 0.001	r = 0.3879 p = 0.000

* includes La Caixa

Significant at alpha = 0.10

CONCLUSION

Based on our preliminary review of six methods for identifying IT Leaders (external quantitative measures, individual case studies, benchmarking, peer review, expert review and citation counts) we believe that expert review and citation counts hold the most promise for a list of European IT leaders that possess high construct, content, and statistical validity. After employing both these methods, we can make an assessment as to the validity of the methods and our findings.

Expert Review

Our primary concern was construct validity; did we actually find European IT leaders as we defined the construct? After surveying 142 IT experts from academics and practice in 10 European companies, we conclude that the method possesses acceptable construct validity. Because many experts provided reasons for nominating companies, we feel confident that they indeed nominated companies based on IT-enabled business success, rather than other definitions of leadership such as IT spend or innovativeness (which may or may not result in business success).

We also believe that the correlation between the expert responses and citation counts provides some evidence of construct validity for the expert review. Although we found a statistically significant relationship between press coverage and expert opinion, the correlations were low enough to suggest that experts did not rely on the trade press to formulate their judgements. We therefore conclude that their opinions were based largely on insider knowledge rather than what they read. We are confident in their judgements, particularly for Germany, Holland and Spain given that in each case there was a relatively high level of responses addressing a relatively small number of company candidates.

We also feel the list generated by expert review possesses high content validity, as 240 European companies appearing on the Global 1000 were assessed. Although some could argue that smaller European IT leaders were overlooked, nominations beyond our original list support our claim of high content validity. In particular, multiple experts nominated each of five additional companies; Lego, La Caixa, Oticon, Fininvest and Benetton. Individual experts also nominated many other companies not on our original list,[2] but they were not included due to lack of sample size. Thus, we believe that enough European companies were assessed in generating the list.

However, we note that the list generated by expert review has low statistical validity, especially for companies in countries with less than six experts responding. To reflect the low statistical validity in our findings, we sorted the list of IT leaders by confidence based on sample size within each country. The consequences of the low statistical validity is that the ranking of the leadership list might change given more information. For example, we have placed Swiss and Swedish companies on the bottom of our list of 42 IT leaders. If more Swiss and Swedish experts responded, these companies might move further up the list, or conversely, might be removed from the list altogether.

Citation Counts

We conclude that the list of IT leaders generated from citation counts, while offering high content and high statistical validity, possesses questionable construct validity. Although the trade press overwhelmingly reports success stories, at least in Belgium and Italy, they may not identify IT leaders. In particular, the press covers expected benefits of IT-related partnerships, but rarely tracks the project to determine if expectations were realized (Lacity & Hirschheim, 1993). Many of these IT promises may have resulted in disappointment. We also note a limitation in our assumption that the overwhelming positive content of Belgian and Italian press reports can be generalized to the other eight European countries. We speculate that there may be cultural differences. In the UK, for example, the press seems more likely to publish named IT failures, such as the computerization efforts at the Department of Social Security or the London Stock Exchange. Concerns about this assumption may further diminish the already questionable construct validity of the IT leaders generated from citation counts.

Contribution of the Research

Finding Europe's IT leaders is a challenge — due to language barriers, cultural attitudes towards rating and comparing companies, cultural effects limiting the amount of IT managers' peer interactions and varying definitions and concepts of leadership. Despite these obstacles, we believe that this research has made a number of contributions:

[2] Some examples of companies which individual experts nominated although they were not on the Global 1000 list include: Ambroveneto Banking Group, AP Moller, Barilla, Bosch, Britannia Life, Coopers & Lybrand, Cheshire County Council, Debis, Grupo Vitalicio, IBM Deutschland, Marathon Oil, Rabo, South Western Electricity, Willis.

Firstly we have drawn attention to the problem of defining IT leadership, and identifying it with high construct, content and statistical validity. When researchers and practitioners are exhorted to learn about IT leadership from case studies, they may now be more questioning of how clearly that leadership is established.

Secondly, we have developed a framework for evaluating the validity of several approaches for finding Europe's IT leaders, according to our own definition. Researchers may replicate these methods to generate lists of their own, or may develop different approaches after understanding the strengths and limitations of the methods we assessed.

Thirdly, we have provided an initial list of European IT leaders. Researchers may use the list to support or challenge alternative claims to IT leadership.

We have already begun a series of case studies to further understand the leadership characteristics of nominated companies. For example, there are several reasons why experts perceive Deutsche Bank as a leader, including a unique approach to software development and an organizational structure which centralizes processing to achieve cost efficiency, data integrity, reliability and security, while decentralizing software development to identified centres of competence. As our cumulative knowledge builds, we hope to provide authoritative statements on what European companies are achieving with IT and to identify best European practices which may be different from those in the USA.

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APPENDIX A
GERMAN EXPERT QUESTIONNAIRE

QUESTIONNAIRE ON INFORMATION TECHNOLOGY LEADERS

The questionnaire asks you to identify Information Technology (IT) leaders in your country. We define an IT leader as follows:

Information Technology (IT) leader: an organization that successfully uses IT to differentiate a company's products, services, and/or prices from its competitors. Examples include using IT to:

Improve product quality
Shorten product development time
Shorten product delivery time
Create new IT-based products
Improve customer service before, during, and after the sale
Create new IT-based customer services
Lower product prices by lowing internal costs, including IT unit costs.

The companies listed in Question 1 were extracted from Business Week's list of Top 1000 Global Companies. We selected this list, which is likely to contain IT leaders, to facilitate your response. Because you may be unfamiliar with some (or many) of the companies listed, feel free to consult colleagues. If you and your colleagues are unable to assess a given company, please mark an 'X' in the 'No Opinion' box. Please do not hesitate to return the questionnaire in the envelope provided, regardless of the number of 'No Opinion' responses.

Please note that the information provided will be held in confidence by the researchers. Information will only be reported on an aggregated basis and individual responses will not be attributed.

Company	Specific business unit (Optional)	Strong claim to be an IT leader	Some claim to be an IT leader	Little claim to be an IT leader	No Opinion
Preussag					
RWE					
Schering					
Siemens					
Thyssen					
VEBA					
Vereinigte Elektrizatswerke Westfalen					
VIAG					
Victoria Holding					
Volkswagen					

2. Please nominate 5 top companies that you perceive as IT 'leaders'. You may select companies listed in Question 1 or you may select additional companies which do not appear in Question 1. Please briefly comment why you perceive these companies as the top IT 'leaders' in your country.

5 Top Information Technology 'leaders'	Comments
1.	
2.	
3.	
4.	
5.	